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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,753	02/06/2004	Robert J. Hamers	032026-0775	4028

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EXAMINER	
CROW, ROBERT THOMAS	
ART UNIT	PAPER NUMBER
1634	

DATE MAILED: 10/30/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/773,753	HAMERS ET AL.	
	Examiner	Art Unit	
	Robert T. Crow	1634	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-24 and 32-37* is/are pending in the application.

4a) Of the above claim(s) *12-24* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11 and 32-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 3.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group I in the reply filed on 9 August 2006 is acknowledged. The traversal is on the ground(s) that the claims are to a product and a process of making the product no longer requiring a step used to make the product, as a result of amendments to claim 12. This is not found persuasive because Inventions I and II are still related as product and process of making. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make another and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the product of Group I can be make by attaching a first biomolecule to a nanocylinder, binding a second biomolecule to said first biomolecule, followed by immobilization of the bound second biomolecule to a substrate to immobilize the entire complex

Applicant also argues that the search would not be burdensome. However, as stated in the Requirement for Restriction filed 13 June 2006, a search for the inventions of all of the groups would not be co-extensive because a search indicating the ***process is*** novel or nonobvious would not extend to a holding that the ***product itself is*** novel or nonobvious; similarly, a search indicating that ***the product is*** known or would have been obvious would not extend to a holding that ***the process is*** known or would have been obvious.

The requirement is still deemed proper and is therefore made FINAL.

2. Applicant's amendments to the claims are acknowledged. Claim 24 now belongs to Group II. Claims 25-31 have been cancelled. Claims 12-24 are withdrawn. Claims 1-11 and 32-37 are under prosecution.

Information Disclosure Statement

3. The Information Disclosure Statements filed 12 July 2004, 9 May 2005, and 3 February 2006 are acknowledged. The International Search Report has been considered but has been lined through because there is no publication date. See 37 CFR 1.98.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-9, 32-34, and 36-37 are rejected under 35 U.S.C. 102(a,e) as being anticipated by Fish (PCT International Publication No. WO 02/054052 A1, published 11 July 2002).

Regarding claim 1, Fish teaches a modified substrate. In a single exemplary embodiment, Fish teaches Figures 2C-D, which show substrate surface 20 having binding agent 16 attached (second embodiment, pages 18-19). The binding agent is a biological molecule; namely, an oligonucleotide probe (page 50, lines 1-5), which binds to analyte 15a, which is a target DNA (page 50, lines 1-2), thereby immobilizing the target as illustrated in Figure 2D. Figures 2C-D further comprise nanotube 26 (i.e., a nanocylinder), having oligonucleotide 26b attached, which hybridizes to analyte 15a (second embodiment, pages 18-19).

Fish also teaches the covalent attachment of the oligonucleotides 26a and 26b to the nanotube; namely, Figure 2F, which illustrates covalent linkage of amino terminal oligonucleotides to the opposite ends of the nanotubes (page 18, last two lines -page 19). Fish teaches the hybridization as illustrated in Figures 2C-D, which attaches the nanotube to the surface through the hybridization between oligonucleotide 26b on nanotube 26 to analyte 15a, which in turn is hybridized to oligonucleotide probe 16 on the substrate surface.

Regarding claims 2-3, Fish teaches the substrate of claim 1, wherein the nanocylinder is a carbon nanotube (page 18, second full paragraph).

Regarding claim 4, Fish teaches the substrate of claim 1, wherein the nanocylinder is a gold nanorod; namely, 26 is a conductive particle (page 18, second full paragraph), wherein the electrically readable (i.e., conductive) particles are metal nanowires having gold as the preferred material (page 34, second full paragraph).

Regarding claims 5-6, Fish teaches the substrate of claim 1, wherein the biomolecules are oligonucleotide sequences; namely, analyte 15a is a target DNA immobilized to the surface via hybridization to oligonucleotide probe 16 (pages 18-19 and lines 1-5 of page 50), and oligonucleotide 26b is on nanotube 26 (pages 18-19).

Regarding claim 7, Fish teaches the substrate of claim 1, wherein the biomolecules form a protein-ligand pair; namely, the single embodiment of Figures 1A-B (first embodiment, pages 14-18). Turning to the Figures, analyte 118 is a protein (page 1, last full paragraph) and binding agent 116 is an antibody that interacts with the analyte (page 4, last full paragraph). Figures 1A-B further comprise antibody 114 bound to electrically readable particle 126 (page 15, last full paragraph), wherein the electrically readable (i.e., conductive) particles are metal nanowires having gold as the preferred material (page 34, second full paragraph).

Regarding claim 8, Fish teaches the substrate of claim 1, wherein the surface biomolecule comprises streptavidin; namely, electrode 30 on surface 20 is gold coated with streptavidin (page 48, lines

8-9). Fish also teaches the complementary molecule on the nanocylinder comprises biotin; namely, biotin attaches the antibodies to gold surfaces (page 48, lines 8-9), and the electrically readable (i.e., conductive) particles are metal nanowires having gold as the preferred material (page 34, second full paragraph).

Regarding claim 9, Fish teaches the substrate of claim 1, wherein the substrate is glass; namely, a glass plate (Example 2, page 56).

Regarding claim 32, Fish teaches a nanocylinder bridge. In a single embodiment, Fish teaches Figure 2D, comprising first surface 20 having binding agent 16 and analyte 15a immobilized thereon (second embodiment, pages 18-19). Figure 2D further comprises second surface 12 having binding agent 16a and analyte 15b immobilized thereon (second embodiment, pages 18-19). The binding agents are biological molecule; namely, oligonucleotide probes (page 50, lines 1-5), and the analytes are target DNAs (page 50, lines 1-2). Figure 2D further comprises nanotube 26 (i.e., a nanocylinder), having oligonucleotides 26a and 26b attached, which hybridizes to their respective analyte DNAs (second embodiment, pages 18-19). The hybridization between oligonucleotides 26a and 26b and analytes 15a and 15b thus forms a bridge with carbon nanotube 26 forming the bridge between surfaces 21 and 20.

Regarding claim 33, Fish teaches the bridge of claim 32, wherein the nanocylinder is a carbon nanotube (page 18, second full paragraph).

Regarding claim 34, Fish teaches the bridge of claim 32, wherein the biomolecules on the nanotube are on opposite ends and are covalently attached; namely, Figure 2F, which illustrates covalent linkage of amino terminal oligonucleotides to the opposite ends of the nanotubes (page 18, last two lines -page 19).

Regarding claim 35, Fish teaches the bridge of claim 32. Fish also teaches that analytes 15a and 15b both must be present (page 19, first paragraph), which is interpreted to mean that they are different sequences. Fish also teaches the oligonucleotides 26a and 26b on nanotube 26, which are interpreted as different sequences as a result of their different numerical labels. Fish also teaches oligonucleotides 16a and 16 on the two surfaces, which are also interpreted as different sequences as a result of their different

numerical labels. Therefore, oligonucleotides 15a, 15b, 26a, 26b, 16, and 16a of Figure 2D are each interpreted as being different sequences, and meet the limitations of the instant claim.

Regarding claim 36, Fish teaches the bridge of claim 32, wherein the first and second surfaces are metals; namely, silicon wafers (Example 1, page 56).

Regarding claim 37, Fish teaches a patterned surface; namely, the electrode array of Figure 9 (sixth embodiment, pages 26-28). Turning to Figure 9, electrodes 30-34 are on a lower insulator substrate, and electrodes 40-42 are on an upper insulator substrate. Each intersection of electrodes performs a different assay to detect different analytes, and each intersection comprises binding agents and electrically readable particles (page 27, lines 1-5) similar to Figure 1A (page 26, last full paragraph). Figure 1A shows electrodes 30 and 31 having binding agents 116 and 117 attached (first embodiment, pages 15-18). The binding agents are biological molecules; namely, antibodies (page 4, last full paragraph), which bind to protein analyte 118 (page 1, last full paragraph). Analyte 118 is attached to electrically readable particle 126 (page 15, last full paragraph), wherein the electrically readable particle is a carbon nanotube (page 34, second full paragraph). Upon binding of the protein to the antibodies (i.e., Figure 1B), the carbon nanotube exemplified particle 126 establishes a pattern on the surface that is predetermined by the biomolecules on the electrodes and the binding agents on the nanotubes bound to the surface bound molecules.

While Fish does not explicitly teach a **plurality** of nanotubes attached to the surface through biomolecular interactions, Fish does teach a plurality of pairs of opposed electrode pairs that enable detection of several different analytes in any sample (page 15, last 5 lines of the first paragraph). Therefore, during use of the substrate, more than one nanotube is arranged on the surface in the pattern predetermined by the placement of biomolecules 116. Further, Figures 2C-D each show a plurality of binding agents 16 and 16a on their respective pairs of electrodes. While only one nanotube is shown bound in Figures 2C-D, Fish does teach specifically bound particles (i.e., a plurality) bound to an electrode (i.e., one electrode; page 17, lines 6-8). Thus, during use of the substrate, more than one

nanotube is arranged on the surface at each electrode in the pattern predetermined by the placement of biomolecules 116.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

8. Claims 1 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fish (PCT International Publication No. WO 02/054052 A1, published 11 July 2002) in view of Strother et al (J. Am. Chem. Soc., vol. 122, pages 1205-1209 (2000)).

Regarding claims 10-11, Fish teaches the modified substrate of claim 1. . In a single exemplary embodiment, Fish teaches Figures 2C-D, which show substrate surface 20 having binding agent 16 attached (second embodiment, pages 18-19). The binding agent is a biological molecule; namely, an oligonucleotide probe (page 50, lines 1-5), which binds to analyte 15a, which is a target DNA (page 50, lines 1-2), thereby immobilizing the target as illustrated in Figure 2D. Figures 2C-D further comprise

nanotube 26 (i.e., a nanocylinder), having oligonucleotide 26b attached, which hybridizes to analyte 15a (second embodiment, pages 18-19).

Fish also teaches the covalent attachment of the oligonucleotides 26a and 26b to the nanotube; namely, Figure 2F, which illustrates covalent linkage of amino terminal oligonucleotides to the opposite ends of the nanotubes (page 18, last two lines -page 19). Fish teaches the hybridization as illustrated in Figures 2C-D, which attaches the nanotube to the surface through the hybridization between oligonucleotide 26b on nanotube 26 to analyte 15a, which in turn is hybridized to oligonucleotide probe 16 on the substrate surface.

While Fish teaches both amine linkages to nanotubes (e.g., Figure 2F) and thiolated oligonucleotides (Example 1; page 56), Fish does not explicitly teach an amine-terminated nanocylinder with a molecule comprising an maleimide group and linkage of the maleimide group to a thiol group.

However, Strother et al teach attachment of biomolecules to surfaces using maleimide derivatives; e.g., Figure 1. Figure 1 shows a thiolated DNA attached to a maleimide moiety, which is further attached to a surface through an amine link and the junction between SSMCC and PL using the heterobifunctional cross linker SMCC (page 1206, column 2, first paragraph). Strother et al also teach the maleimide crosslinker SSMCC advantageously results in an activated surface that is coupled in aqueous solution to yield modified surfaces (page 1206, column 2, first paragraph).

It would therefore have been obvious to a person of ordinary skill in the art at the time the invention was made to have modified substrate comprising the amino terminal nanotubes linked to biomolecules as taught by Fish with the SSMCC linkage as taught by Strother et al with a reasonable expectation of success. The ordinary artisan would have been motivated to make such a modification because said modification would have resulted in an activated surface that is coupled under aqueous conditions as explicitly taught by Strother et al (page 1206, column 2, first paragraph).

Conclusion

11. No claim is allowed.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Robert T. Crow whose telephone number is (571) 272-1113. The examiner can normally be reached on Monday through Friday from 8:00 am to 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ram Shukla can be reached on (571) 272-0735. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Robert T. Crow
Examiner
Art Unit 1634

JULIET C. SWITZER
PRIMARY EXAMINER